



Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

AFRL RESEARCH SUPPORTS THE DEVELOPMENT OF HIGH-TEMPERATURE SUPERCONDUCTING TECHNOLOGY



AFRL demonstrated that minute additions ($<1\%$) of certain divalent rare earth elements can improve the properties of yttrium barium copper oxide (YBCO) superconducting films. Scientists discovered that when small quantities of rare earth elements are well-dispersed throughout the YBCO superconductor, they act as nanopinning centers and improve the critical current.



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Accomplishment

The superconductor community previously considered smaller-percentage additions of rare earth elements to have little impact on the superconducting properties of rare earth barium cuprate superconductors. Therefore, they used larger-percentage additions (10%, 20%, and so on). The elements cerium (Ce), terbium (Tb), and praseodymium (Pr) were detrimental as large additions; consequently, scientists ignored these elements. However, AFRL experts hypothesized that the divalent rare earth elements' detrimental nature has potential uses. They demonstrated the validity of this hypothesis (for Ce and Tb) for higher in-field critical currents. AFRL is optimizing the result to determine this method's maximum possible improvement. The laboratory will soon begin testing on Pr-doped samples.

Background

AFRL conducts research in advanced high-power systems. This research supports the development of high-temperature superconducting technology, which is an essential element for the design and development of future advanced, compact, high-power generator coils and magnets for aerospace applications such as directed energy weapons.

Propulsion
Emerging Technologies

Additional Information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (05-PR-17)